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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/965,370	09/26/2001	Hua Chung	APPM/6303/CPI/COPPER/PJS	6507

7590 11/28/2005

Patent Counsel  
Applied Materials, Inc.  
P.O. Box 450-A  
Santa Clara, CA 95052

EXAMINER

FULLER, ERIC B

ART UNIT	PAPER NUMBER
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1762

DATE MAILED: 11/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/965,370

Applicant(s)

CHUNG ET AL.

Examiner

Eric B. Fuller

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-7,9-42 and 44-69 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7,9-42 and 44-69 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's amendments have overcome the rejections of the previous Office Action. These rejections have been withdrawn accordingly. Applicant's arguments are moot in view of the new grounds of rejection.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-7, 9-31, 33-42, and 44-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1).

Lopatin ('954) teaches a process of forming a barrier layer of tantalum, tungsten, or titanium, and nitrides or silicides thereof (column 5, lines 19-25). The barrier layer is formed by ALD to a thickness of 20-300 angstroms (column 5, lines 29-31). Two copper seed layers are taught and are formed by ALE or CVD (column 5, line 40 - column 6, line 54). The bulk copper layer is deposited by CVD (column 6, lines 55-67). The reference is silent to the seed layer comprising other metals besides copper.

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However, Lopatin ('799) teaches that copper seed layers alloyed with aluminum or magnesium decreases electro-migration (abstract; column 3, lines 1-15). A nitrogen grading is additionally responsible for increased adhesion (abstract; column 3, lines 1-15). It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use the constituents of the seed layer of Lopatin ('799) in the process taught by Lopatin ('954). By doing so, one would reap the benefits of the bulk copper layer having better adhesion to the barrier layer and decreased electro-migration.

As to claims 31, 42, and 44-69, the claims read "less than about 20 angstroms" (emphasis added). It is the position of the examiner that 20.00001 is "about 20 angstroms". Since 20 is less than 20.00001, the reference anticipates "less than about 20 angstroms".

Claims 31, 32, 42, and 44-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (US 6,368,954 B1) in view of Lopatin et al. (US 6,174,799 B1), as applied to the claims above, and further in view of Tsai et al. (US 6,309,964 B1).

Lopatin, in view of Lopatin, teach the limitations above. In the event the applicant does not agree with the examiner's position that 20 angstroms reads on "less than about 20 angstroms", the examiner has provided Tsai. Tsai teaches barrier layers of the same material being effective at a thickness of 10 angstroms (column 3, lines 40-46). It would be apparent to one of ordinary skill that this would use less material and/or

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would decrease the size of the semiconductor. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to use a thickness of 10 angstroms for the barrier layer in the process taught by Lopatin. By doing so, one would reap the benefits of using less material and/or creating a smaller semiconductor, while still producing an effective barrier layer. This also reads on claim 32.

### ***Conclusion***

Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Fuller whose telephone number is (571) 272-1420. The examiner can normally be reached on Mondays through Thursdays.

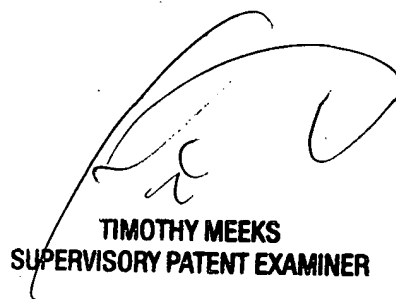
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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks, can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



EBF



**TIMOTHY MEEKS**  
**SUPERVISORY PATENT EXAMINER**